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EXAMINER	
DANG, TRUNG Q	

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 03/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/706,034	MIYANO, KIYOTAKA	
	Examiner	Art Unit	
	Trung Dang	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 December 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) *1-4* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 5-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohuchi (US 6,762,468 of record) in view of Verret (US 6,130,144) and Bar-Gadda (US 6,579,805 of record).

The rejection is maintained as of record and repeated herein.

With reference to Figs. 7(a)-7(d), the Ohuchi teaches method of manufacturing a semiconductor device comprising:

forming source/drain regions **20** formed in a semiconductor substrate;

forming a gate insulating film **6a** on a channel region between the source/drain regions;

forming a gate electrode **8a** made of SiGe on the gate insulating film (Fig. 7(b));

thermally oxidizing the gate electrode in an oxidation condition such that **silicon** in the SiGe gate electrode is **selectively oxidized** to form oxide sidewalls **12** (col. 7, lines 32-39).

Ohuchi differs from the claims in not disclosing that the oxidation

atmosphere contains an oxidant for selectively oxidizing Si and a reductant for reducing Ge.

Verret teaches that when a SiGe layer 32 is oxidized in steam, a SiO2 layer 36 is formed by consuming the Si of the SiGe layer 32 without substantially disturbing the Ge in the SiGe underneath thereby forming a thin layer of essentially pure Ge 34 (Fig. 2c and col. 5, lines 6-16). That is, according to Verret's teaching, the selective oxidation of Si in the SiGe layer to form an oxide layer is performed in steam. Thus, one of ordinary skill in the art would readily recognize that in order to achieve Ohuchi's selective oxidation, the oxidation condition would have been steam.

It would have been obvious to modify Ohuchi's teaching by performing the selective oxidation in steam as suggested by Verret because it is well settle that the selection of a known material (i.e., steam) based on its suitability recognized in the art for its intended use supported a prima facie obviousness determination (MPEP 2144.07).

Bar-Gadda discloses that steam for use in an oxidation process for producing silicon dioxide is generated by admitting H2 and O2 into an oxidation chamber and the H2 and O2 react to form steam in close proximity to the semiconductor wafer (col. 2, lines 30-39). The wet oxidation process for producing SiO_2 according to the reaction: $Si + H_2O \rightarrow SiO_2 + H_2$ (col. 2, lines 30-39). Evidently, H_2 is produced by the reaction and therefore present in the steam oxidation atmosphere. Thus, Bar-Gadda's reference is a factual evidence showing that the steam oxidation atmosphere taught in the

combined process of Ohuchi and Verret contains both oxidant (H_2O) for oxidizing Si and reductant (H_2) for reducing Ge as claimed.

As for claims 8 and 11, since the steam oxidation atmosphere that contains H2O and H2 as mentioned above produces the same result as claimed, the partial pressure ratio of H2O to H2 must be inherent within the claimed range, absent evident to the contrary.

3. Claims 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Verret and Bar-Gadda cited above.

The admitted prior art of Fig. 26 teaches a method of manufacturing a MOS transistor comprising the steps of:

forming a SiGe monocrystal channel layer including a channel region on a semiconductor substrate;

forming source/drain regions in the SiGe monocrystal channel layer formed on the semiconductor substrate;

forming a gate insulating film on the channel region between the source/drain regions; and

forming a gate electrode on the gate insulating film, wherein the gate insulating film is formed on a surface of the SiGe monocrystal layer by thermally oxidizing the SiGe monocrystal layer.

Note that, although not illustrated in the figure drawing, the admitted prior art implies the formation of source/drains regions because the MOS transistor must have source/drain regions.

The admitted prior art differs from the claims in that while the admitted prior art forms the gate insulating film by a conventional oxidation process that results in a gate oxide film containing SiO2 and GeO2, the claims call for an oxidation process in an atmosphere that contains an oxidant for oxidizing Si and a reductant for reducing Ge so that the gate insulating film is made of substantially silicon oxide.

Verret teaches that when a SiGe layer 32 is oxidized in steam, a SiO2 layer 36 is formed by consuming the Si of the SiGe layer 32 without substantially disturbing the Ge in the SiGe underneath thereby forming a thin layer of essentially pure Ge 34 (Fig. 2c and col. 5, lines 6-16). That is, according to Verret's teaching, the selective oxidation of Si in the SiGe layer to form an oxide layer is performed in steam.

It would have been obvious to one having ordinary skill in the art to modify the admitted prior art by oxidizing the SiGe channel layer in steam as suggested by Verret because the oxidation condition set forth by Verret would produce a gate insulating film contains only SiO2. The making of a gate insulating film containing only SiO2 is desirable because it is recognized in the art that GeO2 has high conductive properties (reference to Hirose is cited herein merely for the purpose of showing this fact), hence the presence of GeO2 in the gate insulating film would alter the insulating properties of the gate oxide and therefore causing detrimental effect on the performance of the

device. Furthermore, the absence of GeO2 would prevent damage imposed on the gate insulating film due to the dissolve of GeO2 in H2SO4 usually used in subsequent processes.

Bar-Gadda discloses that steam for use in an oxidation process for producing silicon dioxide is generated by admitting H2 and O2 into an oxidation chamber and the H2 and O2 react to form steam in close proximity to the semiconductor wafer (col. 2, lines 30-39). The wet oxidation process for producing SiO_2 according to the reaction: $Si + H_2O \rightarrow SiO_2 + H_2$ (col. 2, lines 30-39). Evidently, H_2 is produced by the reaction and therefore present in the steam oxidation atmosphere. Thus, Bar-Gadda's reference is a factual evidence showing that the steam oxidation atmosphere taught in the combined process of the admitted prior art and Verret contains both oxidant (H_2O) for oxidizing Si and reductant (H_2) for reducing Ge as claimed.

As for claims 15 and 18, since the steam oxidation atmosphere that contains H2O and H2 as mentioned above produces the same result as claimed, the partial pressure ratio of H2O to H2 must be inherent within the claimed range, absent evident to the contrary.

Response to Arguments

4. Applicant's arguments filed 12/28/05 have been fully considered but they are not persuasive.

In page 3 of the Remarks, applicant argues that "The Examiner then relied on Verret to cure Ohuchi's deficiencies regarding claim 5. The Examiner cited Verret as a teaching of "performing the selective oxidation in steam." Id. Even assuming the Examiner's characterization of Verret is correct, this still does not constitute a teaching of "thermal-oxidizing the conductive film in anatmosphere that contains an oxidant for oxidizing the first semiconductor and a reductant for reducing the second semiconductor, to form an oxide film made of the first semiconductor on the conductive film," as recited in claim 5. The Examiner disagrees. The claimed limitation "thermal-oxidizing the conductive film in an atmosphere that contains an oxidant for oxidizing the first semiconductor and a reductant for reducing the second semiconductor, to form an oxide film made of the first semiconductor on the conductive film," is met by the combination of Ohuchi, Verret, and Bar-Gadda, not Ohuchi taken with Verret alone. Verret reference was employed in the rejection to show that steam is an oxidation condition in which SiGe is selectively oxidized to form silicon dioxide while Ge in the SiGe layer is not oxidized, hence one of ordinary skill in the art would readily recognize that in order to achieve Ohuchi's selective oxidation of the SiGe gate electrode 8a, the oxidation condition would have been steam as clearly addressed in the body of the rejection. Similarly, in page 4 of the Remarks, applicant argues that "...because Bar-Gadda also fails to teach or suggest "thermal-oxidizing the conductive film in an atmosphere that contains an oxidant for oxidizing the first semiconductor and a reductant for reducing the second semiconductor, to form an oxide film made of the first semiconductor on the conductive

film," as recited in claim 5. For example, Bar-Gadda only teaches a process for oxidizing silicon, without any reference to a second semiconductor, let alone "a reductant for reducing the second semiconductor," as recited in claim 5. In response, once again the claimed limitation "thermal-oxidizing the conductive film in an atmosphere that contains an oxidant for oxidizing the first semiconductor and a reductant for reducing the second semiconductor, to form an oxide film made of the first semiconductor on the conductive film," is met by the combination of Ohuchi, Verret, and Bar-Gadda, not Bar-Gadda alone. Bar-Gadda reference was employed in the rejection to show the fact that steam for use in an oxidation process is generated by admitting H_2 and O_2 into an oxidation chamber and the H_2 and O_2 react to form steam. The wet oxidation process for producing SiO_2 according to the reaction: $Si + H_2O \rightarrow SiO_2 + H_2$ (col. 2, lines 30-39). Evidently, H_2 is produced by the reaction and therefore present in the oxidation atmosphere. Thus, Bar-Gadda's reference is a factual evidence showing the fact the oxidation atmosphere in steam of combined process of Ohuchi and Verret contains both oxidant (H_2O) and reductant (H_2). In page 5 of the Remarks, applicant argues that "Moreover, Applicant disagrees with the Examiner's assedion that "[i]t would have been obvious to modify Ohuchi's teaching by performing the selective oxidation in steam as suggested by Verret because it is well settled that the selection of a known material (i.e. steam) based on its suitability recognized in the art for its intended use supported a prima facie obviousness determination (MPEP 2144.07)." Office Action, p. 3 (emphasis added). Contrary to the requirements of MPEP 2144.07, Verret fails to

teach or suggest any suitability of steam for "thermal-oxidizing the conductive film in an atmosphere that contains an oxidant for oxidizing the first semiconductor and a reductant for reducing the second semiconductor, to form an oxide film made of the first semiconductor on the conductive film," as recited in claim 5. In response, as noted in the rejection, the Examiner relied on the following facts to conclude that the selective oxidation of the SiGe gate electrode 8a to form oxide sidewalls 12 using steam would have been obvious:

a) Reference to Ohuchi: teaches thermally oxidizing the SiGe gate electrode 8a in an oxidation condition such that silicon in the SiGe gate electrode is selectively oxidized (i.e. Si is oxidized but not Ge). Ohuchi is silent as to what oxidation condition is employed in the oxidation process.

b) Reference to Verret: teaches steam is an oxidation condition in which SiGe is selectively oxidized to form silicon dioxide while Ge in the SiGe layer is not oxidized (Fig. 2c and col. 5, lines 6-16)

Thus, in light of the facts presented in a) and b), one of ordinary skill in the art would take no effort to recognize that in order to achieve Ohuchi's selective oxidation, the oxidation condition would have been steam. Therefore, the proposed combination is a prima facie case of obviousness because the realization of employing a known technique to achieve the same purpose (i.e. selective oxidation) would have been obvious as indicated in MPEP section 2144.07.

In conclusion, applicant appears to present arguments on the basis of piecemeal analysis. However, applicant is reminded that it is axiomatic that one cannot show nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. See In re Keller, 642 F.2d 413, 208 USPQ 871(CCPA 1981)., In re Merck & Co., 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trung Dang
Primary Examiner
Art Unit 2823

3/20/06